

Orientation to Medical Simulation Website for First Year Medical Students – a Usability Study

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Abstract: Since the publication of *To Err is Human* (2000) which documented 98,000 deaths per year attributed to medical error, the use of simulation based medical education (SBME) as a mitigation strategy has become ubiquitous. There are three basic stages of SBME including the orientation, scenario and debriefing. The orientation stage is recognized to enhance learning by providing information, activities and context to prepare learners to engage in the simulation scenario and debriefing. The average age of medical students is 24 years. As part of Generation Z they utilize online resources daily and are adept at working independently and researching information as they need it. To meet the needs of first year medical student's request for more orientation, an online asynchronous module was developed. This usability study measured the module's learnability, efficiency and error rate, satisfaction and ability to prepare the student for simulation. While results found evidence of an excellent usability, additional data found a low effectiveness rate which improved through iterative design work. Qualitative analysis provided valuable modification strategies and interesting future modifications. This study discusses usability testing methods, evaluation instruments, participant data, and user experience. The value of conducting a usability study as part of the instructional design process proved valuable.

Keywords: orientation, medical simulation, website, usability, medical student

Introduction

Simulation has been used as a strategy for the military to train soldiers for hundreds of years and in aviation to train pilots and crews since the 1930's. In the medical field robotic manikin simulators became available in the 1990's to simulate patient conditions for medical education (Rosen, 2008). In 2000 the Institute of Medicine (IOM) reported that 98,000 deaths occur annually due to medical errors (Kohn, 2000). This number was likely underreported as a 2008 US Department of Health and Human Services reported 180,000 medical error related deaths among Medicare beneficiaries alone (Levinson, 2010). One strategy recommended to recover from medical errors is simulation whereby learners practice medicine using a robotic patient manikin in a safe learning environment.

Simulation has become ubiquitous in the healthcare education of students and practicing professionals (Tyerman, 2018) and is widely used in nearly all medical and osteopathic schools (Huang, 2012).

A simulation has three basic elements: (1) an orientation of the learner to the simulation environment, roles and learning objectives; (2) a simulated patient event called a scenario, and finally; (3) a debriefing of the learner's activities through reflection and feedback. There are numerous academic research studies regarding the construct and facilitation of the simulated patient scenario and debriefing elements, but it is only recently that the orientation element has been recognized as essential to learner outcomes.

This usability study took place in a large public university medical school located in the Western part of the U.S. where students enjoy an expansive and engaging problem-based learning curriculum with simulation interspersed. Within the first few weeks of starting medical school, students receive a synchronous classroom lecture and later, a brief onsite orientation immediately prior their first simulation. The onsite orientation at the manikin bedside is completed either through a pre-recorded audio file or facilitator, minutes prior to their first scenario. Student post-course survey results consistently reveal some confusion, anxiety and requests for more preparation. As a simulation specialist working in the simulation center, the researcher sought to evaluate the usability of a newly designed asynchronous web-based orientation to simulation resource.

Literature Review

Education and Web-based education

Web-based learning is extraordinarily flexible, scalable and allows embedding media for both students and faculty to learn novel or review just-in-time information (Dankbaar, 2014). Scalability can relate to the volume of learners and shared resources between courses. The current population of medical students are predominantly Generation Z with an average age of 24 and have had the internet their entire lives (Admitted Class Profile-Office of Admissions, 2019). These students prefer independent learning through online research and Seemiller (2017) notes the importance of incorporating this culture of intrapersonal learning and media into higher education. Hopkins (2017) expounds upon the convenience and efficiency that online learning provides and even proposes university medical centers to develop education websites as a framework for connected learning.

Medical students are highly motivated and adept at utilizing digital information relevant to their needs (Mahan, 2014). A Delphi study by McDermott (2016) found that 94.4% of experts used video as a part of orientation for preparing participants for simulation. While simulation centers have created orientation videos in the public domain and private online orientation courses for their faculty, it was difficult to find open source web-based learning directed to medical students. The design of this project will fill this resource gap for medical students.

Facilitation

Simulation facilitators are subject matter experts who orient and guide learners through the simulation scenario and conduct the post scenario debriefing session. Examples of facilitator responsibilities include orienting the learners to the scenario objectives, physical environment, roles and responsibilities. During the scenario, facilitators extend guidance by delivering cues or hints, operate manikin technology, and play roles such as the patient voice and bedside nurse. After the scenario, facilitators are responsible to debrief learners through reflective questioning allowing students to discover knowledge and performance gaps, discuss new or alternate strategies and information to reach learning objectives and receive direct feedback (Keskitalo, 2014). Lioce (2015) noted that facilitative approaches should be structured and consistent between learners, yet Khamis (2016) notes that sessions often are not standardized to principles of instructional design. The high cognitive load for facilitators coupled with varying experience levels with simulation and technology may impact the completeness and effectiveness of the learner orientation.

Orientation Module Content

McDermott (2016) noted that orientation is vital to student success and may enhance a richer reflection during debriefing and reduced anxiety. Orientation was also found to positively impact medical students' confidence and performance (Bommer, 2017). The International Nursing Association for Clinical Simulation and Learning (INACSL, 2016) states that elements of an orientation should include the expectations for the simulation, patient history, presentation and environment, roles assumed by the learners and facilitator, and how to order tests or call for additional assistance. These elements were included in two modules of the website: *simulation* and *simulation room*. To access the course students must create an account and register in the learning management system (LMS). This element comprised a third *create account* module of the website. To facilitate learning, information was presented in chunks and logically sequenced (Miller, 1956; Gagne, 1992).

Usability Testing

Usability is a term used to describe how easy a person finds a particular system, design or interface to manipulate in order to process a function or solve a problem. Nielsen (2012) describes five components of usability. The researcher focused on learnability, efficiency, error rate and satisfaction elements.

- Learnability or how easy a user can complete tasks in a first-time encounter
- Efficiency or how quickly a user can perform tasks in subsequent encounters
- Effectiveness as measured by completion of tasks
- Satisfaction that users feel when using the design.
- Memorability or how easy can users reestablish performance after a period of having not used the website

In order to test the usability of a website, a cognitive walkthrough method allows analysis of participant reactions as they navigate through the design. Subjects are asked to vocalize what they are thinking as they respond to a series of tasks created by the researcher. The computer monitor is recorded and interviews done in-person allow

reactions like facial expressions to be documented (Krug, 2010). Questions like, “what are you thinking?” are interview type questions used by researchers to help identify the cognitive processes of participants as they perform tasks (Polson, 1992).

The system usability scale (SUS) consisting of a 10-item questionnaire “1” strongly disagree to “5” strongly agree can be used to measure user perception (Brooke, 1996). The SUS questions look at both usability and usefulness and have been shown to be reliable in small sample sizes, while being easy to administer and score (Brooke, 1986). Lewis (2018) comments that the SUS can effectively differentiate between usable and unusable systems and therefore is a valid tool (see Appendix A to view the SUS scale). Each odd-numbered question response of the SUS is scored by subtraction of one. For example, if the participant answered “3” then 3 minus 1 equals a score of 2. Each even numbered question response is scored by subtracting it from 5. For example, if the participant answered an even numbered question “1” then 5 minus 1 equals a score of 4. The sum of all ten scored questions are multiplied by 2.5. The final raw score can be compared to an adjective rating from “worst imaginable” to “best imaginable” (Bangor, 2009). For example, acceptable corresponds to a raw score of above 70, and unacceptable below 50.

Methodology

Three research questions were developed to aid in the evaluation of the online orientation module for first year medical students:

1. How easy is it for first year medical students to navigate the orientation to simulation website?
2. Do first year medical students feel the content of the orientation website prepares them for a future simulation?
3. How satisfied are first year medical students with the orientation to simulation website?

Purpose Statement

The purpose of this usability study was to evaluate the ease of navigation, usefulness of content, and student satisfaction to an orientation to simulation website for first year medical students.

Content Analysis

This instructional module incorporated learning strategies from the cognitive domain using an organized web-based design to present information needed to prepare students to successfully participate in a simulation scenario. Merrill (2002) identified instructional design phases that prime learners to solve real-world problems. This design theory assisted in determining topic level content for the website by engaging learners through scaffolded information and use of video demonstrations. Problem-based learning curriculums at medical schools transformed teachers’ roles to be more facilitative and students to become more independent and collaborative (Goldie, 2015). In providing an asynchronous orientation to simulation in the form of a website, the researcher hoped to

expose learners early on to simulation and support their need for prerequisite knowledge, preparing them to apply skills and work collaboratively with their peers and facilitator.

The primary instructional goal of the project was to prepare learners to actively participate and apply treatment solutions when presented with a manikin patient medical problem. The researcher created a hierarchy chart that further helped define information and skills critical to student learning (Krathwohl, 2002) (see Appendix B to view the learning objective hierarchy chart).

- Registering for a course
- Administration of a safety net: Intravenous access, oxygen, monitoring the patient, call for help.
- Applying a treatment plan

Participants

The primary target group were first year medical students (MS1) aged 18 or older enrolled in a school of medicine at a large public university. These students had completed an undergraduate degree often in biological sciences and are in the top 4% of all applicants. The average age of MS1's was 24 years and 88% are residents (Admitted Class Profile-Office of Admissions, 2019). In general, medical students are socially conscious and desire to make a positive impact in the educational circles they are a part of. All are enrolled in small problem-based learning groups and display highly independent work ethics and collaborative teamwork.

Recruitment

The researcher intended to recruit first year medical students however, it became necessary to recruit from a wider pool of second year students to obtain participants for the study. Students were contacted through email, posters within the medical school, and by personal invitation with information about the study (see Appendix C for recruitment material). A screening survey was completed by each participant to ensure they met entrance criteria (see Appendix D). A gift card to a nearby coffee shop (\$5 each) was offered to compensate subjects for their time.

Evaluation Instruments

Presurvey. To gather data about participants, a presurvey was distributed prior to the usability walkthrough (see Appendix E). The presurvey consisted of four sections. The first two sections gathered demographic information such as age, gender, medical school year, experience with simulation. The third and fourth section gathered participants' perception of preparedness to the orientation they received synchronously prior to their first scenario at the simulation center using a Likert-scale scale anchored at the ends (1 = strongly disagree; 5 = strongly agree); as well as satisfaction (1 = extremely dissatisfied; 5 = extremely satisfied). The screening and evaluation instruments were developed using Google Forms.

Usability Study Plan. This plan was created to provide a general overview of the elements of the usability study, data collection and analysis (see Appendix F).

Usability checklist. A checklist was created to ensure all steps, instructions and tasks was conducted for each participant (see appendix G).

Usability Protocol, Script and Tasks. The usability protocol and script included the complete process of testing the online orientation through cognitive walkthrough interviews (see Appendix H). While the researcher planned to conduct the interviews online, all testing was done face-to-face at the school's computer lab (see Appendix I for Zoom set up instructions for participants). Participants were given a copy of the usability tasks to refer to during the walk-through including the task difficulty question using a Likert-scale (1 = very difficult; 5 = very easy) (see Appendix J).

Observation Notes. An observation note sheet was used during the usability study to collate tasks, questions and participant responses and comments (see Appendix K). Only analyzed data is shared in this report. Recordings and surveys were only retained for the duration of the study and erased upon its completion. The interview took about twenty minutes and a total of thirty to forty minutes to complete the protocol.

Post Survey. At the end of the interview, participants completed an online post survey which included SUS questions to measure participant's perceived usability of the website (see Appendix L). To gain insight into how participants rated the ability of the online module to prepare them to work with the facilitator, understand their role, assess the patient manikin, and apply equipment a Likert-scale was used (1 = strongly disagree; 5 = strongly agree). Subjects were asked to rate their satisfaction to the asynchronous module's navigation, design, video, organization, and non-video content using a five-point Likert-scale anchored at the ends (1 = extremely dissatisfied; 5 = extremely satisfied). Finally, subjects were asked, how likely they were to recommend the website to a medical student using a different five-point Likert-scale was used (1 = extremely unlikely; 5 = extremely likely). They were then asked to explain their rating.

Revision Priority

Nielson's Severity Rating for Usability Problems (2012) was utilized to determine the priority of website revisions between each iteration and at the conclusion of the study (see Appendix M). Due to the time constraints of this project, efforts were made to fix those problems that had the highest severity rating and easily modified.

Project Design

The online orientation was designed using WordPress to allow the use of themes and back-end coding to modify and customize content and mobile friendly functionality. The ARCS model of motivation (Keller, 1987) was incorporated into the design to establish the relevance of the material and satisfaction in learning through the use of novelty and surprise, matching content to meet student needs and linking it to learning success. The web design included curated learning modules with simple readable text and images presented in chronological order paralleling user needs. Garrett (2016) describes critical website design elements that affect user engagement; optimizing navigation, graphics, organization, content utility, purpose, simplicity and readability. An encouraging writer

tone was used. White space and a clean look were used to support student enjoyment of the website. Seemiller (2017) confirmed that Generation Z learner's enjoy watching others perform new skills before trying it out themselves. Short skill videos were recorded from a participant's point of view as seen in Figure 1. Videos were produced by the researcher and uploaded through YouTube which allows subtitle/closed captions, playback speed adjustment and transcription.



Figure 1. Video produced from a participant's point of view.

The website consisted of three instructional webpage modules as seen in Figure 2, including an *about us* section at the bottom hyperlinked to the simulation center's LMS. This was an efficient way to keep contact information updated between both resources. Since all learners must first create an account in the LMS, the orientation module's *create account* webpage was placed on the homepage for efficiency. Learners could click a hotlink which would open the LMS in a new tab. They could then view the module's *create account* webpage side by side and complete the task. The second *simulation* module oriented the learner to the use of simulation and the role of student and facilitator. The third module oriented learners to the simulation room, equipment, and safety. Because the project involved a usability study, the evaluation was not on the effectiveness of the instructional content directly, but the content was critical to exploring learner's satisfaction to the design (see Appendix N for the initial wireframe).



Figure 2. Image of the Orientation to Simulation home page.

Procedures

Prior to contacting potential participants, the researcher completed IRB approval and CITI training regarding human subjects' research and information privacy security (see Appendix O). Individuals who were interested in participating in the study took a screening survey to determine eligibility. Eligible participants were emailed a consent form to complete (see Appendix P). Participants were informed of the procedures, intent

of the study and that they were under no obligation and could withdraw from the study at any time without penalty. An enrollment log was used to organize results from screening and consent fulfillment (see Appendix Q).

There were three rounds of usability testing with three groups of participants (4,4,6) and two iterations of the website. With participant's written consent, their computer screen and audio comments were recorded utilizing the screen share recording function and stored in a password protected secure drive. Specific scenario-based and problem-solving tasks were scripted to understand the participant's ability to navigate the website, attempt realistic activities and gain insight into problematic areas. During the study, participants were given a written copy of tasks to refer to and encouraged to think aloud and ask questions. This allowed the researcher to follow-along with the subject's thinking process. Participants were asked not to use the search widget or "find" hotkeys to allow discovery of usability issues. A set of facilitative questions were created as a resource for the researcher to encourage unbiased participant activity and critical thinking should the participant stall in their talk-aloud narrative during the study (see Appendix R). Participants were notified they could ask questions about the website during the study, but the researcher may opt to reserve answering until the study was completed. This would mimic a situation where a visitor to the website would not have assistance. Both the usability protocol and script were modified from Krug (2010).

Three sets of usability tasks were developed (see Appendix R). Each task was accompanied by a single ease question (Sauro, 2009) to measure the participant's perception of task difficulty. Participants were allowed 3 minutes in the first task to navigate anywhere on the home page and verbalize what they were thinking.

Task 1: Please take a few minutes and explore the homepage of the website and verbalize whatever comes to mind. You may scroll but please don't click any links.

The second set of tasks had to do with navigation (Task 2-3).

Task 2: You are a new medical student and need to create an account in the SimTiki website. Locate the instructions on how to do this.

Task 3: You wonder if it is okay to ask questions during a simulation. Locate where you can find this information.

The last set of tasks had to do with effectiveness of the content of the design (Task 4-6).

Task 4: Before your simulation scenario you wonder how you will get the patient's history. Locate where you would find this information.

Task 5: Find information on how to activate a new blood pressure reading during a scenario.

Task 6: You anticipate having to start an IV on the manikin during a scenario next week. Locate where you would learn how to do this.

Finally, the participant completed a post course survey to gain information about usability and attitudinal response to the orientation.

Timeline

The implementation of this project was during both fall 2019 and spring 2020 semesters. Reviews of the project prototype was conducted by critical friends who were graduate study peers, subject matter experts in simulation, and the learning technology professor (see Appendix S for the timeline).

Analysis and Results

Presurvey

Fourteen medical students ($n = 14$), 9 females and 5 males in spring 2020 were recruited (Table 1). Seventy-two percent of the participants were older than the 2019 class average age of 24 years. First year medical students comprised a little over half of the group. Most of the students (93%) had participated in simulation three or more times and four of the fourteen (29%) had researched medical simulation as second year (MS2) special interest group (SIG) student directors. Student led SIGs plan extracurricular activities with physician advisers.

Table 1

Demographics of Participants ($n = 14$)

Characteristics	Number	Percentage
Age		
18 – 24	4	28 %
25 - 34	10	72 %
Gender		
Female	9	64 %
Male	5	36 %
Medical School Year		
First Year	8	57 %
Second Year	6	43 %
Previous Sim Experiences		
0 times	1	7 %
3 – 5 times	8	57 %
6 or more times	5	36 %
SIG student directors		
	4	29 %

Note. All four of the SIG student directors were MS2 students.

Cognitive Walkthrough

Although online interview procedures were developed, all interviews were conducted face to face. Recruitment of the target first-year medical students took longer than anticipated. Second-year medical students were initially recruited to the first iteration and provided valuable data that prompted a design modification improving effectiveness and efficiency of the module. The participant's computer monitor and audio was recorded during the interview. The process of data collection included three iterations (4-4-6) for a total of fourteen ($n = 14$) participants. The ability of participants to complete a task and time to complete were recorded to measure effectiveness and efficiency (Mifsud, 2015). After each task, a task difficulty question was asked. A post survey was conducted after

the walkthrough was completed. The researcher analyzed the data and used Nielson's severity rating scale to advise the revision between iterations. Interestingly, during the walkthrough, several subjects repeatedly shared that they would normally use hotkeys, Ctrl-F to search a webpage to solve tasks.

Effectiveness

Task Effectiveness was the completion rate that users achieved for specific tasks. In the first iteration composed of four MS2 students, it was discovered that Task 4 had an effectiveness completion rate of 50% while all other tasks reached a completion rate of 100%. Task 4 required participants to locate how they would find the patient history before a patient simulation scenario. Two participant scores were zero because they either incorrectly completed the task, as one subject said, "I guess if you can ask clarifying questions you can get a history," or seemed frustrated with the task prompting the researcher to end the activity. This was rated as a major usability problem and important to fix.

Figure 3 shows the addition of a bullet point to the student section of the simulation webpage after the first iteration of subjects were observed to scan this section more closely than the facilitator section. One participant commented, "I just skipped the facilitator part and went to the student area to find if ok to ask questions." This highlights the unique opportunities that observation and questioning during a cognitive walkthrough can yield. In later iterations, the researcher bolded other important terms in this section.

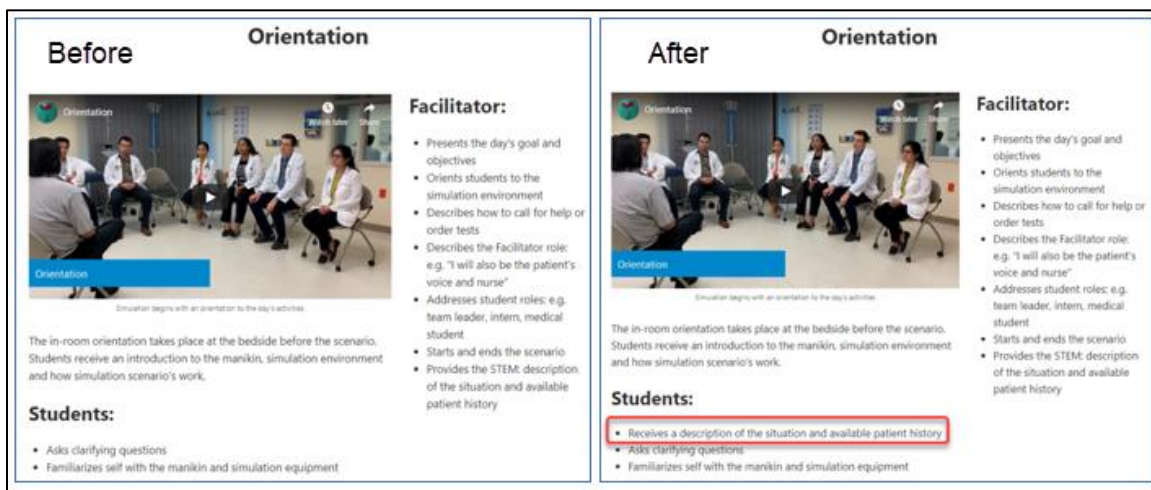


Figure 3. This figure shows the simulation section before (left) additional text was inserted into the student section outlined in red.

Task Efficiency

Task Efficiency was measured in the time it takes for a participant to successfully complete a task. Figure 4 shows completion times for Task 2 through Task 6. Task 1 was not included as it had a set time of 180 seconds. Other than Task 4, task rates generally got faster as subjects performed subsequent encounters. The researcher's decision to place the *create account* module on the home page for efficiency appeared to have been a good strategy as reflected by the faster rate of completion average of 5.14 ($SD = 3.16$) for

Task 2, which prompted, “you are a new medical student and need to create an account in the SimTiki website. Locate the directions on how to do this.”

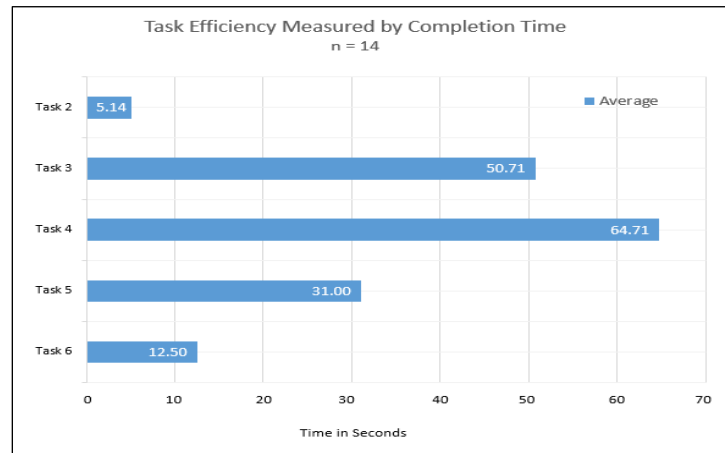


Figure 4. Task efficiency measured by completion time. Task 2 is not shown as it involved exploring the homepage for 180 seconds (3 minutes).

The researcher was interested in the learnability of the online orientation. Would first-time subjects' complete tasks faster as they moved through the task questions? If participants were able to complete subsequent tasks faster, that would suggest that they were navigating the site faster and learning to use the website. To answer this question, the average task times of Task 3, 5, and 6 were compared. Several tasks were excluded from this comparison because Task 1 had a set time of 180 seconds, Task 2 was a task occurring on the home page with an average efficiency rate of 5.14 ($SD = 3.16$) seconds, and Task 4 was problematic. The results of comparing Tasks 3, 5, and 6 in terms of completion time suggested the website was learnable as shown in Figure 5.

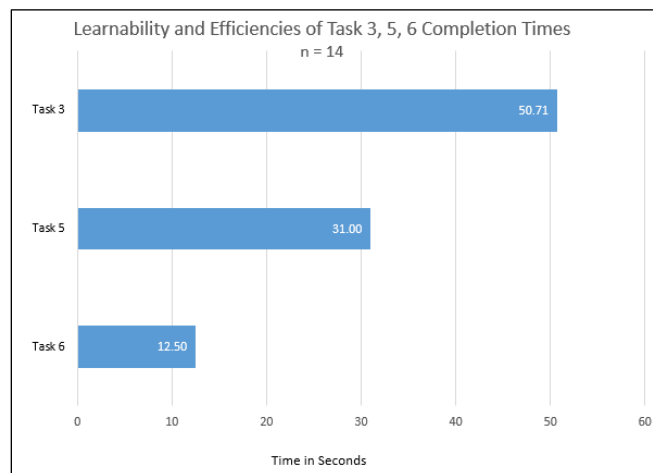


Figure 5. The completion times of Tasks 3, 5, and 6 showed that participants completed subsequent tasks faster, suggesting the website was learnable.

Perception of Task Difficulty

A modified 5-point Likert scale (1 = very difficult, 5 = very easy), was used to gauge participant's perception of the difficulty of usability tasks. It asked, "how easy was it to accomplish the task?" In retrospect the question may have been biased and should have asked "how difficult or easy was it to accomplish the task?" The average rating for Task 4 had a lower average of 3.57 ($SD = 1.02$) compared to the overall tasks average of 4.53 ($SD = 0.81$). The task difficulty question was useful in its simplicity to immediately identify problematic tasks and ask the "why" question. In scoring Task 4, one participant commented that "there was a lot of reading." Interestingly, two participants who did not complete Task 4 in the first iteration rated the task as a four. This might be ascribed to the high self-efficacy of the MS2 subjects who have attained assurance of their capabilities in approaching difficult tasks verses MS1 students (Artino, 2012).

System Usability Score

The system usability score (SUS) was 82.5 ($SD = 7$). This placed the website far above the average of 68 for usability (Sauro, 2018). SUS scores can also be ascribed to adjectives and this design could be said to have excellent usability (Bangor, 2009). Using Suaro's (2012) correlation between the SUS and the Net Promoter Score which designates three categories of people who would either recommend, be neutral or likely to discourage others from using a system or company; the SUS score placed subjects solidly in the promotor category. This corresponded to the post survey satisfaction question, "how likely they were to recommend the (orientation) website to a medical student," which averaged 4.79 ($SD = 0.58$). Immediately after answering the recommendation question, subjects were asked to briefly explain their answer. Comments included, "This would be really nice prior to the first ... experience. Going in I did not understand really the roles, dynamics between students and the facilitator or what the mannequins could/could not do," and "I would highly recommend this website to any incoming ... student prior to a ... event. It clearly shows you what to expect, how to do specific tasks such as checking BP, and how to register for classes/complete post-survey quiz. One-stop shop for all things necessary to enjoy ... and focus on learning the medicine!" The researcher was concerned that simulation terminology might be introduced inadvertently to the orientation module and add difficulty to the content. However, all subjects rated the terminology as easy to understand.

Satisfaction

Participants were asked in the pre-survey to rate their satisfaction with the synchronous orientation experience which included lecture and later, a brief onsite orientation immediately prior their first simulation. This experience occurred in the first few weeks of medical school. A 5-point Likert scale was used (1 = extremely dissatisfied, 3 = neutral, 5 = extremely satisfied). The average rating was 3.00 ($SD = 0.86$). Comments regarding the synchronous orientation included, "I really don't remember any prior orientation, I remember being a bit confused," and, "orientation was sufficient, but felt a little unsure of the physical logistics."

Participants rated their satisfaction with the online orientation based on five elements: ease of navigation, design, videos, organization and non-video elements. On a 5-point Likert scale, the average satisfaction rating was 4.5 ($SD = 0.57$) was achieved.

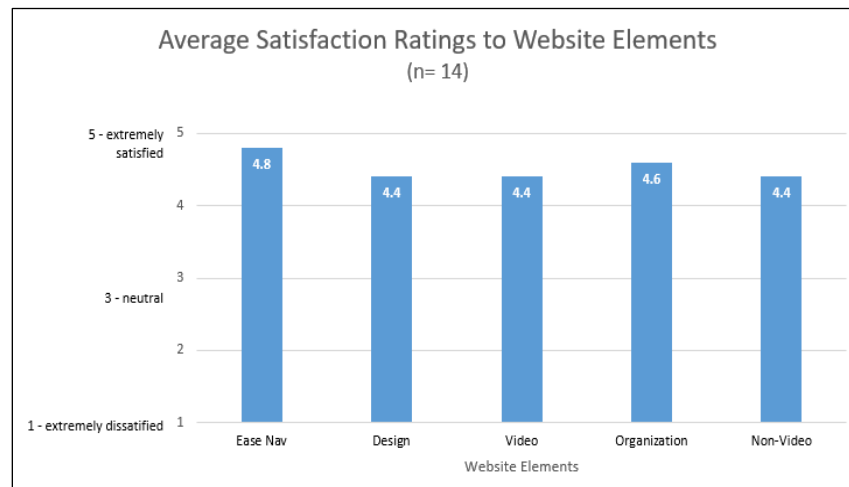


Figure 6. Average participant satisfaction ratings by website elements.

At the end of the post survey, participants were given an opportunity to freely share with the researcher. Comments included, “I think this could be super useful to students for their first-time going in. It really takes a lot of the mystery out of the ... experience and gives us the chance to be more effective and get more out of our first experience,” and “I think this project is a great idea as it provides information about the equipment and expectations of the learner. If I had the opportunity, I would have used this website prior to my first”

Preparedness

The researcher compared student’s rating of the synchronous orientation method (lecture and later, a brief onsite orientation immediately prior their first simulation) to the new asynchronous orientation modules’ ability to prepare them to work with the facilitator, understand their role in simulation scenarios, assess the patient manikin and apply equipment used in the scenario. The average preparedness rating for the synchronous method was 2.82 ($SD = 0.87$). The average preparedness rating for the asynchronous website was 4.69 ($SD = 0.53$) as seen in Figure 7.

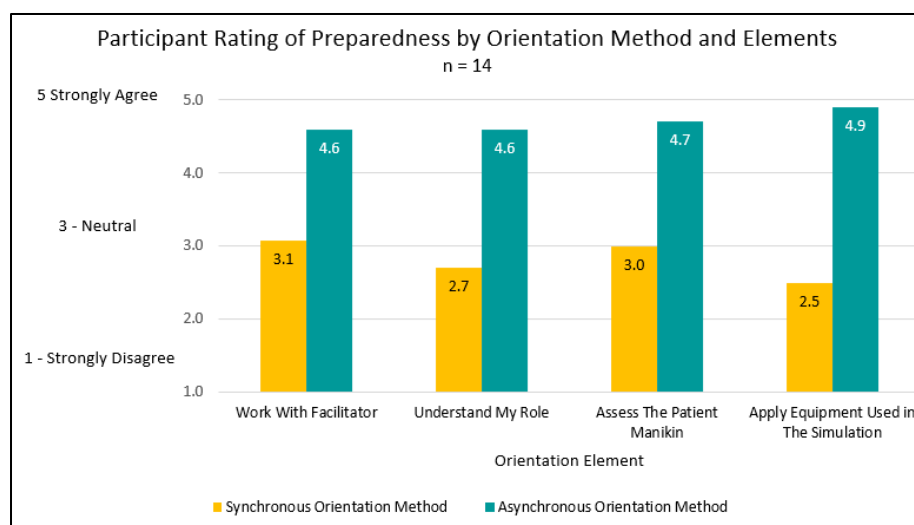


Figure 7. A comparison of participants' average ratings of elements by orientation method (synchronous vs. asynchronous).

Discussion

The purpose of this usability study was to evaluate the ease of navigation, usefulness of content, and student satisfaction to an online orientation to simulation for first year medical students. The participants were a mix of MS1 and MS2 medical students. While MS2 students had more experience with simulation, both groups reported enthusiastic support for continued use of the online module. Usability testing through iterative cognitive walk-through testing allowed identification of design and content problems, as well as response to modifications through effectiveness and efficiency rates measured by task completion and time. Subjects often gave spontaneous suggestions as they interacted with the online orientation which may not have been captured if only a survey was done. Small changes in content such as adding one additional bulleted phrase improved usability dramatically. There were three 3-neutral ratings of satisfaction to video content. This seemed important to consider because all other ratings for surveyed elements were rated higher. One subject commented that narration could be added to skills videos. This reflected Mayer's (2003) multimedia research indicating animation and narration are more powerful in transferring knowledge compared to using only animation and text. All skills videos were done by the researcher with one hand holding the iPhone and the other performing the skill. This may also have also influenced the video satisfaction ratings. Adding a second camera person would add stability to the video image.

The website will need to be modified to include personal protective equipment (PPE) guidelines due to the recent COVID-19 pandemic. It is tempting to expand the website to include other simulation center features but care must be taken to preserve the original goal of orienting first-year medical students. This study can be used as a benchmark to compare future usability testing of the website. Modifications based on student suggestions are being considered including adding narration to videos, addition of an

FAQ section, and adding a resource webpage and links to documents for student special interest group directors.

Technology and web design tools continue to advance, so the researcher's task will not end. To keep the content relevant and credible, regular review and revision will be needed to update content including images and video. Usability testing should be a part of testing significant updates to the design (De Jong, 2018).

Conclusion

This project was developed in response to medical students' need for expanded orientation to simulation. This study demonstrates the value of conducting usability testing as part of the instructional design process. With little resources, the researcher was able to iteratively improve an online resource. Qualitative data through both interviews and surveys revealed insights for modification and potential future additions to the project.

In just the few months in which this study was completed, a dramatic shift in the use of PPE and social distancing has occurred for all face to face academic instruction. Asynchronous online resources can be easily modified to current information and guidance. With each succeeding class of medical students, ongoing surveillance is needed to identify needs, develop content, and test potential solutions. The researcher hopes this particular resource will continue to augment and provide a node where individuals and groups can access initial and just-in-time learning to prepare for simulation activities. It is anticipated that a wider range of users such as advanced medical students, tutorial group leaders, facilitators, new staff and faculty and international fellows would also find the website useful. Finally, when researching this project, it was difficult to find similar content on open sourced websites for novice medical students. The researcher hopes this project might serve as a demonstration for other simulation centers to develop online resources matched to their students' needs using instructional design and usability testing methods.

References

- Admitted Class Profile – Office of Admissions. (n.d.). Retrieved September 29, 2019, from <https://admissions.jabsom.hawaii.edu/prospective-students/admitted-class-profile/>
- Artino AR. (2012). Academic self-efficacy: From educational theory to instructional practice. *Perspectives on Medical Education*, 1(2), 76-85.
- Bangor, A, Kortum, P., & Miller, J. (2009). Determining what individual SUS scores means: Adding an adjective rating scale. *Journal of Usability Studies*, 4(3), 114- 123.
- Brett-Fleegler, M., Rudolph, J., Eppich, W., Monuteaux, M., Fleegler, E., Cheng, A., & Simon, R. (2012). Debriefing assessment for simulation in healthcare: Development and psychometric properties DASH. *Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare*, 7(5), 288–294.
- Brooke, J.(1996). SUS: A “quick and dirty” usability scale. In P.W. Jordan, B. Thomas, B.A. Weerdmeester and I.L. McClelland (Eds.), *Usability Evaluation in Industry* (pp. 189–194). London, UK: Taylor & Francis.
- Dankbaar, M. E. W., & de Jong, P. G. M. (2014). Technology for learning: How it has changed education. *Perspectives on Medical Education*, 3(4), 257–259. <https://doi.org/10.1007/s40037-014-0141-0>
- De Jong, M. D. T., & Wu, Y. (2018). Functional complexity and web site design: Evaluating the online presence of UNESCO World Heritage sites. *Journal of Business and Technical Communication*, 32(3), 347–372. <https://doi.org/10.1177/1050651918762029>
- Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992). Principles of instructional design (4th ed.). Forth Worth, TX: Harcourt Brace Jovanovich College Publishers.
- Garett, R., Chiu, J., Zhang, L., & Young, S. D. (2016). A literature review: Website design and user engagement. *Online Journal of Communication and Media Technologies*, 6(3), 1–14.
- Goldie, J. G. S. (2016). Connectivism: A knowledge learning theory for the digital age? *Medical Teacher*, 38(10), 1064-1069.
- Hopkins, L., Hampton, B. S., Abbott, J. F., Buery-Joyner, S. D., Craig, L. B., Dalrymple, J. L., Page-Ramsey, S. M. (2018). To the point medical education, technology, and the millennial learner. *American Journal of Obstetrics and Gynecology*, 218(2), 188–192. <https://doi.org/10.1016/j.ajog.2017.06.001>
- Huang, Sacks, Devita, Reynolds, Gammon, Saleh, Passiment. (2012). Characteristics of simulation activities at North American medical schools and teaching hospitals: An

- AAMC-SSH-ASPE-AACN collaboration. Simulation in Healthcare : *Journal of the Society for Simulation in Healthcare*, 7(6), 329-333.
- INACSL standards of best practice: Simulation facilitation. (2016). *Clinical Simulation in Nursing*, 12, S16–S20. <https://doi.org/10.1016/j.ecns.2016.09.007>
- Keller, J. M. (1987). Development and use of the ARCS model of instructional design. *Journal of instructional development*, 10(3), 2-10.
- Khamis, N. N., Satava, R. M., Alnassar, S. A., & Kern, D. E. (2016). A stepwise model for simulation-based curriculum development for clinical skills, a modification of the six-step approach. *Surgical Endoscopy*, 30(1), 279–287. <https://doi.org/10.1007/s00464-015-4206-x>
- Kohn, L. T., Corrigan, J., & Donaldson, M. S. (2000). *To err is human: Building a safer health system*. Washington, DC: The National Academies Press.
- Krathwohl, D. R. (2002). A revision of Bloom’s taxonomy: An overview. *Theory Into Practice*, 41(4), 212–218. https://doi.org/10.1207/s15430421tip4104_2
- Levinson, D. R. (2010). *Adverse events in hospitals: National incidence among Medicare beneficiaries*. (Report No. OEI-06-09-00090). Retrieved from <https://oig.hhs.gov/oei/reports/oei-06-09-00090.pdf>
- Lewis, J. (2018). The system usability scale: Past, present, and future. *International Journal of Human-Computer Interaction*, 34(7), 577-590.
- Krug, S. (2010). *Rocket surgery made easy: The do-it-yourself guide to finding and fixing usability problems* (Voices that matter). Berkeley, Calif.: New Riders.
- Lioce, L., Meakim, C. H., Fey, M. K., Chmil, J. V., Mariani, B., & Alinier, G. (2015). Standards of best practice: Simulation standard IX: Simulation design. *Clinical Simulation in Nursing*, 11(6), 309–315. Retrieved from <https://doi.org/10.1016/j.ecns.2015.03.005>
- Mahan, J., & Clinchot, D. (2014). Why medical education is being (inexorably) re-imagined and re-designed. *Current Problems in Pediatric and Adolescent Health Care*, 44(6), 137-140.
- Mayer, R. E., & Moreno, R. (2003). Nine ways to reduce cognitive load in multimedia learning. *Educational psychologist*, 38(1), 43-52.
- Mifsud, J. (2015, June 22). Usability metrics—A guide to quantify the usability of any system. Retrieved October 20, 2019, from Usability Geek website: <https://usabilitygeek.com/usability-metrics-a-guide-to-quantify-system-usability/>

- Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological review*, 63(2), 81-97.
- Merrill, M.D. (2002). First principles of instruction. *Educational Technology, Research and Development*, 50(3), 43-59.
- McDermott, D. S. (2016). The prebriefing concept: A delphi study of CHSE experts. *Clinical Simulation in Nursing*, 12(6), 219–227. Retrieved from <https://doi.org/10.1016/j.ecns.2016.02.001>
- Nielsen, J. (1994, November 1). Severity ratings for usability problems. Retrieved October 25, 2019, Retrieved from <https://www.nngroup.com/articles/how-to-rate-the-severity-of-usability-problems/>
- Nielsen, J. (2012, January 3). Usability 101: Introduction to Usability. Retrieved November 16, 2019, from Nielsen Norman Group website: <https://www.nngroup.com/articles/usability-101-introduction-to-usability/>
- Polson, Lewis, Rieman, & Wharton. (1992). Cognitive walkthroughs: A method for theory-based evaluation of user interfaces. *International Journal of Man-Machine Studies*, 36(5), 741-773.
- Rosen, K. R. (2008). The history of medical simulation. *Journal of Critical Care*, 23(2), 157–166. Retrieved from <https://doi.org/10.1016/j.jcrc.2007.12.004>
- Seemiller, C., & Grace, M. (2017). Generation Z: Educating and Engaging the Next Generation of Students. *About Campus*, 22(3), 21–26. <https://doi.org/10.1002/abc.21293>
- Sauro, J., & Dumas, J. S. (2009, April). Comparison of three one-question, post-task usability questionnaires. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 1599-1608). ACM.
- Sauro, J., & Lewis, J. (2012). Predicting net promoter scores from system usability scale scores [Blog post], Retrieved from <https://measuringu.com/nps-sus/>
- Sauro, J. (2018, September 19). MeasuringU: 5 Ways to Interpret a SUS Score. MeasuringU. <https://measuringu.com/interpret-sus-score/>
- System Usability Scale (SUS). (n.d.). Retrieved September 29, 2019, from <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>
- Tyerman, J., Luctkar-Flude, M., Graham, L., Coffey, S., & Olsen-Lynch, E. (2019). A systematic review of health care presimulation preparation and briefing effectiveness. *Clinical Simulation In Nursing*, 27, 12–25. Retrieved from <https://doi.org/10.1016/j.ecns.2018.11.002>

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Appendix A
System Usability Scale

1. I think that I would like to use this website frequently
2. I found the website unnecessarily complex to use
3. I thought the website was easy to use
4. I think that I would need the support of a technical person to be able to use this website
5. I found the various functions in this website were well integrated
6. I thought there was too much inconsistency in this website.
7. I imagine that most people would learn to use this website very quickly
8. I found the website very cumbersome to use
9. I felt very confident using the website
10. I needed to learn a lot of things before I could use this website

Appendix B
Learning Objective Hierarchy Chart

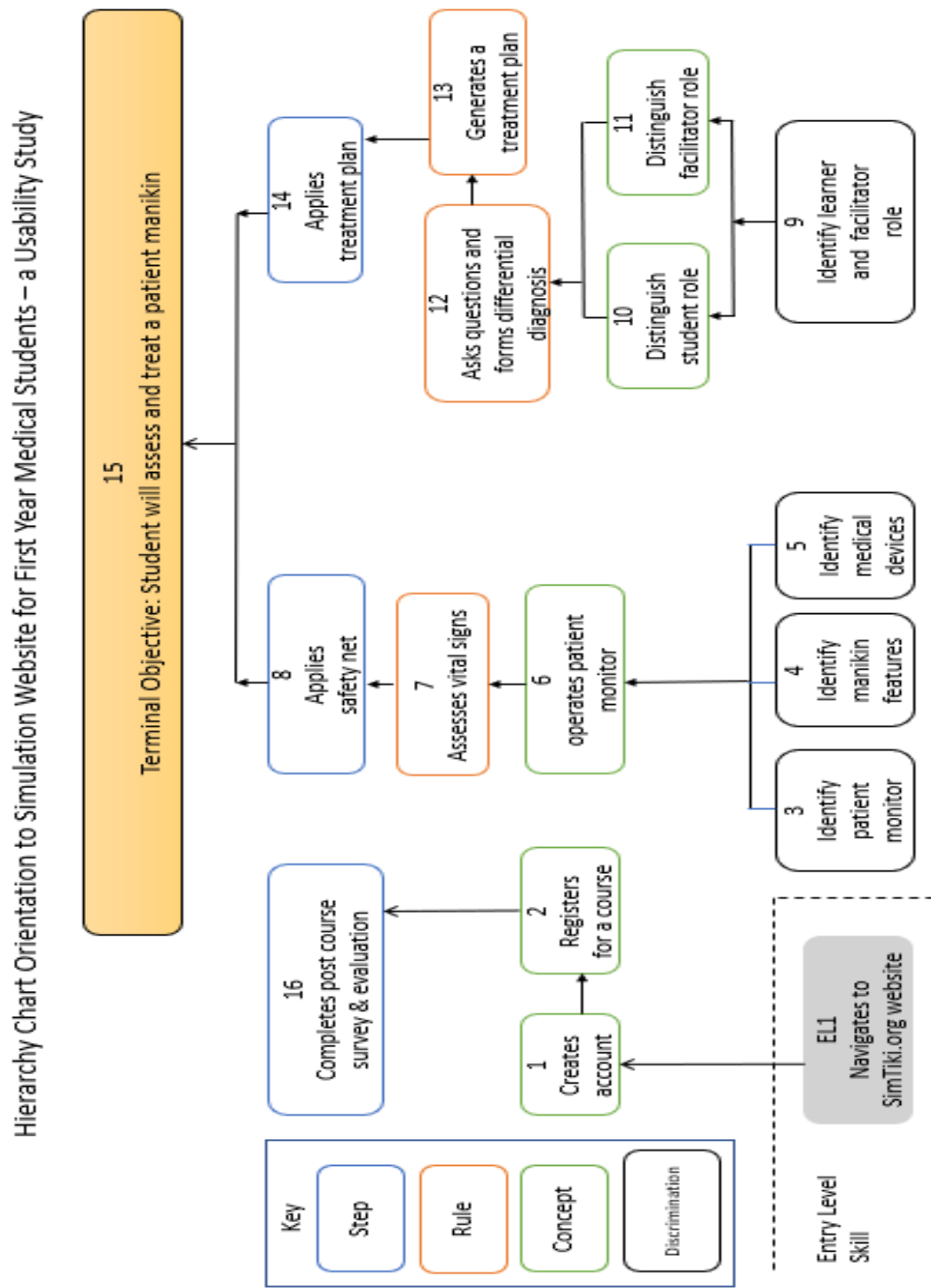


Figure B1. Learning objective hierarchy chart.

Appendix C Recruitment Material

Invitation to Participate in an Orientation to Simulation Usability Study

Kris Hara harakm@hawaii.edu
To Potential Participant

Aloha,

My name is Kris Hara and I am a Master's student in Learning Design and Technology Department at the College of Education, University of Hawai'i at Mānoa. I am emailing you because you are a [first year medical student / second year medical student]. As part of my final Master's project, I have developed an orientation to simulation website for first year medical students. I would like to invite you to participate in my usability study to test the website for its navigability, relevance and user satisfaction. Your feedback will be invaluable to the developed website and subsequent revisions for future users.

Participation in this usability study is strictly voluntary. Your participation is strictly voluntary and you may end your participation at any time. The usability study involves an individual interview with you and will take no more than 35 minutes. Interviews with you will be conducted in-person or online if needed, using a software program called Zoom. The interview will involve a 5 minute Pre-Questionnaire [online form], 20 minute testing of the usability of the website, and a 10 minute Post Questionnaire [online form]. I will be conducting three rounds of interviews during the following date ranges:

- Round 1: January 2020
- Round 2: February 2020
- Round 3: March 2020

Each round will allow changes to the website based on feedback from the participants. If you are interested and available to participate in this usability study please complete the Pre-Screening survey {link}. Once received, I will follow up with a confirmation email and a Consent to Participate form. We will go through the consent form again during the time of the interview.

Mahalo for your consideration,
Kris Hara, Project Investigator, harakm@hawaii.edu

The link within the email will take the participant to a Google Form Screening survey (see Appendix E).

Invitation to Participate in an Orientation to Simulation Usability Study

Kris Hara harakm@hawaii.edu

To Participant

Aloha {Participant's Name},

Thank you very much for completing the Pre-Screening survey. I know your time is valuable and am very grateful that you considered participating in my research study. Unfortunately, I have filled all available spots and no longer require additional participants. I do appreciate your interest. I would like to follow-up on this project in the future, I plan to present the results online at the 2020 Teaching, College and Community Online conference. This international virtual conference encompasses various topics related to distance learning and technologies for teaching and learning. You may visit <https://tcchawaii.org/> for additional information.

Mahalo!

Kris Hara, Project Investigator, harakm@hawaii.edu

Example of a follow-up email for participants who did not pass the Pre-Screening requirements.

Invitation to Participate in an Orientation to Simulation Usability Study

Kris Hara harakm@hawaii.edu

To Participant

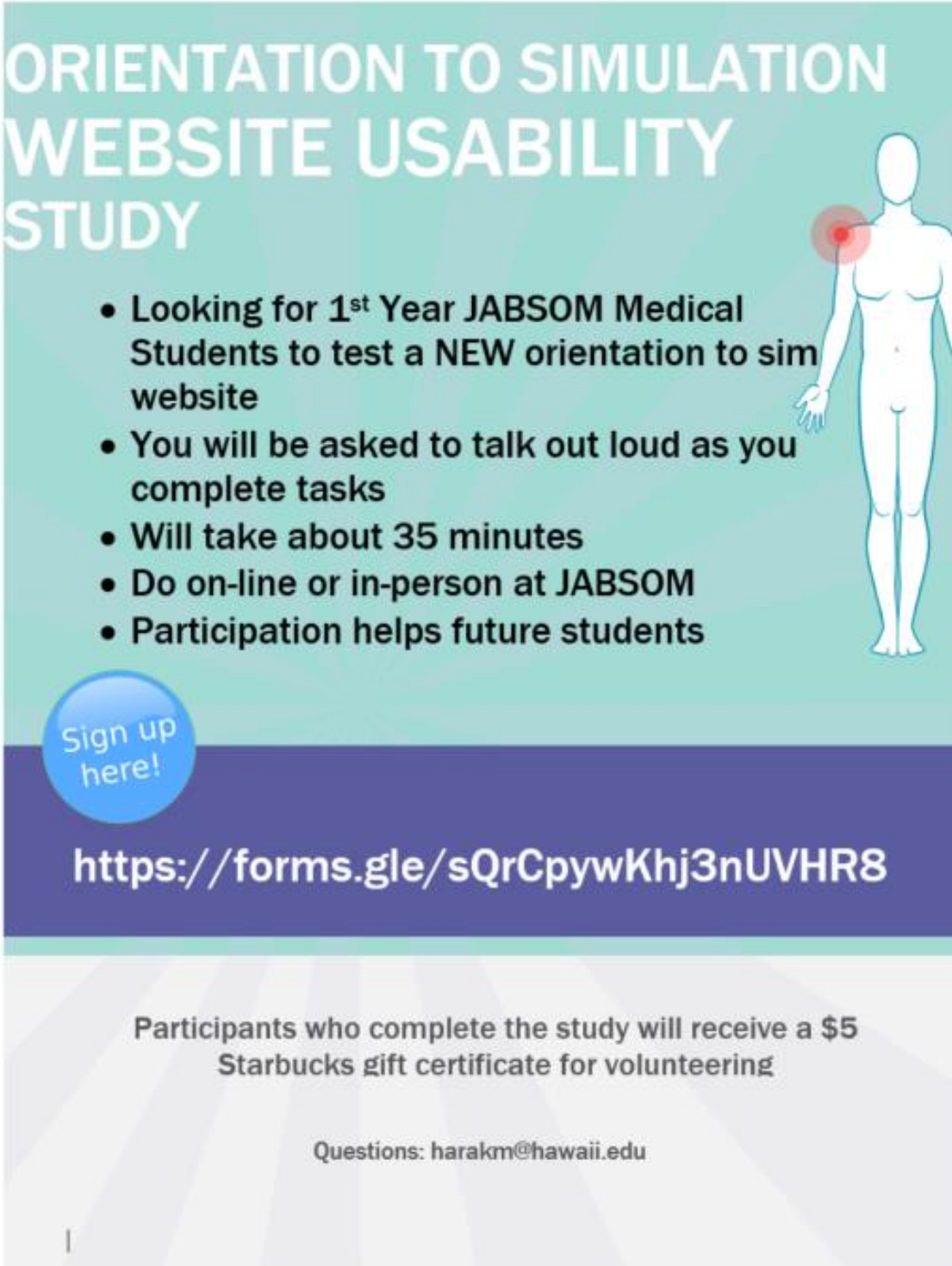
Aloha {Participant's Name},

Thank you very much for completing the Pre-Screening survey regarding the Orientation to Simulation usability study. Your participation is strictly voluntary and you may end your participation at any time. I have attached the Informed Consent form for your review. Please read through the form which contains more information about the study and what you'll be doing should you consent. If you do agree to participate, please sign the form and return by email, inter-departmental mail or in person. If you have any questions about the study, please do not hesitate to contact me.

Mahalo nui loa,

Kris Hara, Project Investigator, harakm@hawaii.edu

Example of follow-up email for participants passing pre-screening requirements. This email is the official invitation to participate and contains the consent form (See Appendix F).



**ORIENTATION TO SIMULATION
WEBSITE USABILITY
STUDY**

- Looking for 1st Year JABSOM Medical Students to test a NEW orientation to sim website
- You will be asked to talk out loud as you complete tasks
- Will take about 35 minutes
- Do on-line or in-person at JABSOM
- Participation helps future students

Sign up here!

<https://forms.gle/sQrCpywKhj3nUVHR8>

Participants who complete the study will receive a \$5 Starbucks gift certificate for volunteering

Questions: harakm@hawaii.edu

I

The poster features a teal background with a white human silhouette on the right side. A red circular highlight is positioned on the silhouette's right shoulder. The text is primarily in white and black, with a blue circular button containing the text 'Sign up here!'. The URL is displayed in white on a dark blue horizontal band. The bottom section has a light purple background with a geometric pattern.

Figure C3. Digital poster that will be used on medial posts such as media displays in public areas of the medical school, as well as printed and posted on bulletin boards and provided to first year students mail boxes.

Appendix D Screening Survey

Screening Survey to Determine Eligibility

This instrument will be used to identify participants who qualify for the usability testing.

1. I am at least 18 years of age or older

Yes No

2. I am a first year medical student at the John A. Burns School of Medicine

Yes No

3. I am a second year medical student at the John A. Burns School of Medicine

Yes No

4. I have access to a computer.

Yes No

5. I have access to the internet.

Yes No

6. I have a built-in or separate computer microphone (e.g. earbuds or headset with mic)

Yes No Not Sure

7. My name

8. My email

9. My phone number

Appendix E

Presurvey

Part 1: Demographics

This survey should not take more than 5 minutes. No names are recorded. Your information will be kept confidential. This portion of the survey will collect demographic data of study participants. All data from the survey will be used to improve the Orientation to Simulation website. Participation is voluntary. Mahalo!

1. What is your age range?
18 – 24
25 – 34
40 - 54
55+
Prefer not to say
2. What is your gender? If you prefer not to answer, choose (N/A)
Male Female N/A
3. What year medical school are you?
1st 2nd

Part 2: Simulation Experience

4. How often have you participated in a medical simulation at JABSOM?
Zero times _____ 3 - 5 times _____
1 – 2 times _____ 6 or more times _____

Part 3 Personal Perception of Preparedness

When answering the next set of the question, think back to your first semester at JABSOM when you were in the Health and Illness module.

Likert Scale 1-5. Strongly disagree, disagree, neither agree nor disagree, Agree, Strongly Agree

5. The content of the orientation to simulation I received PRIOR to the MD1 Health & Illness scenario
 1. Prepared me to work with the facilitator.
 2. Prepared me to understand my role in simulation scenarios.
 3. Prepared me to assess the patient manikin.
 4. Prepared me to find and apply equipment used in simulation scenarios.

Part 4: Satisfaction

Likert Scale 1-5 from Extremely Dissatisfied, Dissatisfied, Neutral, Satisfied, Extremely Satisfied

6. How satisfied were you with the orientation you had received PRIOR to the MD1 Health & Illness scenario?
7. Please share any additional comments with the researcher.
Open text

Appendix F Usability Study Plan

1. Usability study plan for a web-based orientation to simulation
2. Purpose

Type of research project: Usability Study
Topic: Orientation to Simulation web-based
Participants: First year medical students at the John A Burns School of Medicine.
Research Site: <https://zoom.us/j/3316411493>

Purpose Statement:
The purpose of this usability study is to evaluate the ease of navigation, ability of content to prepare students, and student satisfaction to an orientation to simulation website for first year medical students at the John A Burns School of Medicine.
3. Areas of inquiry
 - a. Navigation
 - b. Relevance
 - c. User satisfaction
4. Research Questions
 - a. How easy is it for first year medical students to navigate the web-based orientation to simulation?
 - b. How relevant do first year medical students find the content of the web-based orientation to prepare for simulation?
 - c. How satisfied are first year medical students with the web-based orientation?
5. Methods

This study will take place in Zoom during scheduled sessions in Spring 2020. Three iterations of four participants individually doing one-on-one usability testing with data collection will occur for each round of testing. The usability tasks will include scanning and short scenarios.
6. Participants

The participants are first year medical students who have already completed several simulation experiences and have basic computer literacy skills. They display a high motivation to excel as individuals as well as collaborative team members in their problem-based learning tutorial groups.
7. Instrumentation

For usability testing a functional computer with ability to access the internet, microphone and webcam or computer camera will be needed. The participant will need to have access to Zoom which will be used to share and record the monitor screen and audio of conversation during the usability test.

8. Timeline for a 35 minute usability test
 - a. Usability test script and online Pre-Questionnaire – 5 minutes
 - b. Usability test – 20 minutes
 - c. Online Post-Questionnaire – 10 minutes
9. Procedure
 - a. Review the usability checklist prior to the test
 - b. Ensure the usability test script is available
 - c. Ensure that the consent form has been signed
 - d. Ensure the usability task sheet is available for both participant and researcher
 - e. The browser URL should be on www.google.com and begin/end screen recorder and note the start time
 - f. Provide an overview of the study by reading the usability test script
 - i. Testing the website and not the participant.
 - ii. Recording form
 - iii. Icebreaker questions
 - iv. Begin usability test by scanning the home page
 - v. Take notes of interesting actions or comments, problems, bugs, procedural errors
 - vi. Hand the usability task sheet to the participant and begin scenario tasks
 - vii. Once the scenario tasks are done STOP the recording
 - viii. Ask participant to complete the post survey
 - ix. Thank the user and give them the incentive gift card or instructions on how they can retrieve it
 - x. Escort the participant them from the room or end the Zoom meeting.
 - xi. Scrub through the recording and store in the secured Google Drive

Appendix G Usability Checklist

Checklist for Usability Test

Orientation to Simulation Website

Kris Hara

Usability checklist

At-A-Glance:

1. Before the test
 - a. Have your usability technology checklist and usability study plan handy.
 - b. Launch Zoom and connect with your usability study participant.
 - c. Have participant check their email for the Zoom Invitation Link if not previously sent.
 - d. Welcome and explain the test to your participant.
 - e. Direct your participant to start Share Screen in Zoom and ensure that they share their entire desktop.
 - f. Work through your usability protocol with your participant.
2. During
 - a. Be prepared to perform any technical support needed.
 - b. Ensure the participant is “thinking aloud” - remind him or her every 45 seconds.
3. After
 - a. Direct your participant to stop Share Screen in Zoom
 - b. Thank your participant and ask if they have any further questions
 - c. End Zoom - Click End (Stop) Recording
 - d. Your archived Zoom screenshare is now stored as a video a separate file on your desktop or (My Documents), and it can be viewed using your computer’s video player (e.g. m3u file). The file will save with a name similar to: yyyy-dd-mm hh.mm.ss your name zoom meeting #####

Facilitator Set Up & Conducting the Study:

1. Set up your computer and attach all cords/peripherals.
2. Plug in to a power outlet (don’t trust the battery).
3. Make sure you are connected to the Internet.
4. Set up audio and test.
 - a. Ensure the microphone is working
 - b. Ensure the volume is at a reasonable level
5. Open your Browser to the Zoom.us website and log into account.
6. Access a previously scheduled meeting by clicking My Meetings, start.
7. Prepare your computer for Zoom:
 - a. Click on “Test computer mic and speakers” to ensure that you audio is working. If you don’t see this popup move your cursor to the bottom of your zoom screen and click the ^ arrow to the right of the mic icon. Choose Computer Audio options,

- Test Computer Mic & Speakers and follow the instructions. Close the popup windows when you are done.
- b. Click on “Join Audio Conference by Computer.”
 - c. Contact participant and ask if their computer is setup and they are ready. If the participant is in the same room, the facilitator should have setup their computer.

When Participant has set up their computer:

8. Invite the participant to the Zoom meeting by email. Alternately the participant can sign in to their Zoom Account at the scheduled time or click the hyperlink supplied when the meeting was scheduled through the researchers account.
 9. Ask the participant to share their entire screen with you. If they don't see the screen share icon, they may have to hover their cursor over the bottom part of their Zoom screen to see the toolbar.
 10. Begin recording the session by clicking “Record” Button.
 - a. When you end your Zoom meeting and terminate the session, the recording will be saved in the Zoom folder within Documents.
 11. Explain the study to the participant. Ensure they understand the directions.
 12. Ask the participant to share their screen. This can be done by clicking on the “Share Screen” button at the bottom of the screen. They may need to point their cursor to the bottom of their Zoom screen to see the button.
 13. When the participant has completed their tasks, direct the participant to end “Share Screen.”
 14. Thank them for their participation and ask if they have any questions.
 15. Copy the post survey link into the chat area or email to the participant.
 16. When you feel the conversation is complete, you may click on “End Recording.” The study is saved to “Documents>Zoom” folder with a date and time.
 17. Ask the participant to complete the post survey.
 18. Thank the user and give them the incentive gift card or instructions on how they can retrieve it
-

After the Study:

1. Navigate to C:\Users\Kris\Documents\Zoom
2. Quickly view (scrub) through the video to ensure the integrity of the audio and video.
3. Store the video in secured Google Drive.

Appendix H Usability Protocol and Script Orientation to Simulation Website

Technology Set up Checklist (Facilitator Computer)

1. Setup up computer connected to power outlet (do not trust the battery).
2. Check internet connection.
3. Test audio
 - a. Microphone working
 - b. Volume is adequate
4. Log in to Zoom account
5. Contact participant to ask if their computer is set up and they are ready to start

Once Participant computer is set up

6. Facilitator invites participant to Zoom meeting room.
7. Test if Zoom is working:
 - a. Start a meeting by clicking “host a meeting” with video
 - b. Click “Join with Computer Audio”
8. Run an audio and screen-share test with Zoom account.

Participant Technology Set up (Participant’s Computer)

9. Sets up computer and connects to a power outlet (do not trust the battery).
10. Check internet connection.
11. When contacted, participant should log into Zoom by clicking the link provided by the facilitator instructions. This was emailed beforehand.
12. Test audio
 - a. Microphone working
 - b. Volume is adequate
13. When both facilitator and participant are ready, begin recording.
 - a. Ask participant to move cursor to the bottom of the Zoom screen and click “Start Recording” button.

Welcome Script (5 minutes)

F2F Preparation Computer

1. Open Browser tabs for survey’s (make sure it’s the survey NOT to edit survey page). If virtual – send hyperlinks.
 - a. Presurvey - <https://forms.gle/qRSwgeDjZxVr9fBS7>
 - b. Post Survey – Orientation to Simulation
<https://forms.gle/wS86okSGJgcwbkXy8>
 - c. Google page
 - d. Website: <https://orientationtosimulation.wordpress.com/>
2. Enable zoom

Participant

1. Consent signed
2. presurvey

3. Browser to Google page

Read Usability script

Hi, _____. My name is Kris Hara, and I'm going to be walking you through this session today. Thank you for your participation.

I am **asking people to try using a website to see whether it works as intended**. The session should take about **twenty minutes**.

The first thing I want to make clear is that we're **testing the site, not you**. You can't do anything wrong here. You don't have to worry about making mistakes.

As you use the site, please try to **think out loud**: to say what you're seeing, trying to do, and thinking. This will be a big help to me.

Also, please **don't worry that you're going to hurt my feelings**. I'm doing this to **improve the site** and need to hear your honest reactions.

You can **ask questions** as we go along but I may not be able to answer them right away, since we're interested in how people do **when they don't have someone sitting next to them** to help.

But if you still have any questions **when we're done, I'll try to answer** them then. And if you need to **take a break** at any point, just let me know.

Do you have any questions so far?

OK. Before we look at the site, I'd like to ask you a question – before this study had you researched medical simulation? Yes No

< GIVE PARTICIPANT COPY USABILITY TASKS>
< START ZOOM RECODRING >

You are a first-year medical student and you want to orient yourself to the SimTiki Simulation Center. You would also like to learn about how and why simulation is used in your medical education. As you understand the benefits of a manikin patient simulation, you would like to get acquainted with the simulation room and available equipment. We'll ask you **NOT** to use the search button to find information during these tasks.

OK let's start looking at the website. Please click the *Website* tab

Home Page Review

Please take a few minutes and explore the homepage of the website and verbalize whatever comes to mind. You may scroll but please don't click any links. Tell me **what you make of it**: what strikes you about it, **what you can do here**, and **what it's for**. Just **look around** and **do a little narrative**. **You can scroll** if you want to, **but don't click on anything yet**. Remember to think out loud.

< START 3 MINUTE TIMER >

At end of 3" ask the task difficulty question and fill in Observation notes (next page of this handout)

How easy to accomplish task?

1 - Very Difficult 2 – Difficult 3 – Neutral 4 – Easy 5 - Very easy

Thanks. Now I'm going to ask you to try doing some specific tasks. I'm going to read each one out loud.

< Make sure to use words that do NOT bias the participant >

I'm also going to ask you to do these tasks **without using Search**. We'll learn a lot **more** about how well the site works that way.

And again, as much as possible, it will help us if you can try to **think out loud** as you go along.

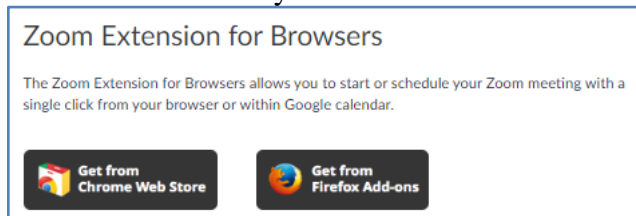
< GOTO next page of this handout >

< **allow the user to proceed through each task until you don't feel like it's producing any value or the user becomes very frustrated.**>

Appendix I

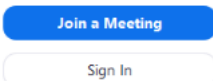
Zoom Set-Up Instructions For Participants

1. If the participant and researcher are not in the same room, the participant will need to have access to a computer and connect through Zoom to complete the study.
2. Be sure to use the latest version of Chrome or Safari.
3. You may want to use in ear headphones connected to your computer, like the ones for a smartphone during the usability study for better sound quality.
4. Before joining the Zoom meeting please download the Zoom app from the [Download Center](#). Otherwise, you will be prompted to download and install Zoom when you click the study link that the researcher will email you.



5. Once the download and installation is complete, click the hyperlink in the email sent by the researcher.
6. Please click Join a Meeting.

zoom

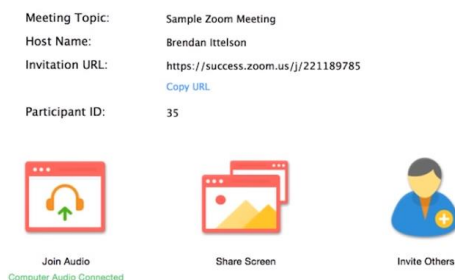


7. Choose the Audio Conference by Computer option.



☐ Automatically join audio by computer when joining a meeting

8. Your screen will look similar to this image.



9. Move your cursor to the bottom left of the image and you can enable or mute audio and video. The image below shows audio and no video



10. To share your screen click the Share Screen icon in the middle of the task bar.



11. If you have any questions please contact harakm@hawaii.edu

Appendix J

Observation Notes During Usability Study

Observation Notes for Orientation to Simulation a Usability Study

Date: _____ Start Time: _____ End Time: _____

Duration: _____

Participant # _____ Usability Study Transcribed by: _____

Notes and Transcription During Usability Study			
Preliminary Script Questions and Responses			
	Prior to medical school had you participated in any medical simulations?	Yes	No
	Prior to this study had you researched medical simulation?	Yes	No

6 Questions

(DO NOT READ) Scenarios for Usability Study aligned with Research Question #1 - How <u>easy</u> is it for first year medical students to <u>navigate</u> the web-based orientation to simulation? Ease of navigation questions (20 minutes):		Time to Accomplish Task min:sec	Task Difficulty: How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	Task relates to:	Task completed =1	Task NOT completed = 0
1	Please take a few minutes and explore the homepage of the website and verbalize whatever comes to mind. You may scroll	3 minutes	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	Home page	Task completed =1	Task NOT completed = 0

	but please don't click any links.					
Comments						
2	You are a new medical student and need to create an account in the SimTiki website. Locate the directions on how to do this.	Time to Accomplish Task min:sec:	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	(Register page) Go back to home page	Task completed =1	Task NOT completed = 0
Comments						
3	You wonder if it is okay to ask questions during a simulation. Locate where you can find this information.	Time to Accomplish Task min:sec	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	(Simulation page) Go back to home page	Task completed =1	Task NOT completed = 0
Comments						
4	Before your simulation scenario you wonder how you will get the patient history. Locate where you would find this information.	Time to Accomplish Task min:sec	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	(Simulation page) Go back to home page	Task completed =1	Task NOT completed = 0
Comments						

5	Find information on how to activate a new blood pressure reading during a scenario.	Time to Accomplish Task min:sec	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	(Equipment page) Go back to home page	Task completed =1	Task NOT completed = 0
Comments						
6	You anticipate having to start an IV on the manikin during a scenario next week. Locate where you would learn how to do this.	Time to Accomplish Task min:sec	How easy to accomplish task? Likert 5 point 1 - Very Difficult 2 - Difficult 3 - Neutral 4 - Easy 5 - Very easy	(Equipment page) Go back to home page	Task completed =1	Task NOT completed = 0
Comments						

Additional participant comments

Please complete the Post Survey

Thank You Very Much

Do you have any questions?

Here is a gift card to thank you for your time!

< STOP ZOOM RECORDING When Participant Leaves F2F Room >

End Zoom Meeting, Scrub through video and stored in secure drive

Check pre/post survey results

eDocuments to secured drive, hardcopies locked up

Appendix K Participant Copy of Usability Tasks

Usability Tasks

You are a first-year medical student and you want to orient yourself to the SimTiki Simulation Center. You would also like to learn about how and why simulation is used in your medical education. As you understand the benefits of a manikin patient simulation, you would like to get acquainted with the simulation room and available equipment. We'll ask you **NOT to use the search button** to find information during these tasks.

Tasks

Task	Description
Scenarios for Usability Study aligned with Research Question #1	
Task 1	Please take a few minutes and explore the homepage of the website and verbalize whatever comes to mind. You may scroll but please don't click any links. (3 minutes)
Task 2	You are a new medical student and need to create an account in the SimTiki website. Locate the directions on how to do this.
Task 3	You wonder if it is okay to ask questions during a simulation. Locate the where you can find this information.
Task 4	Before your simulation scenario you wonder how you will get the patient's history. Locate where you would find this information.
Task 5	Find information on how to activate a new blood pressure reading during a scenario.
Task 6	You anticipate having to start an IV on the manikin during a scenario next week. Locate where you would how to do this.

Appendix L

Post Survey

Questions 1 through 15 are a five-point Likert scale 1-5 from Strongly Disagree, Disagree, Neither agree or disagree, Agree, Strongly Agree.

Name:

Email address:

Thank you for completing the usability testing of a web-based orientation to simulation.

The following questions will help the researcher understand your experience and improve the website.

Part 1: Usability

Likert Scale 1-5. Strongly disagree, disagree, neither agree nor disagree, Agree, Strongly Agree

1. I think that I would like to use this website frequently.
2. I found the website unnecessarily complex.
3. I thought the website was easy to use.
4. I think that I would need the support of a technical person to be able to use this website.
5. I found the various functions in this website were well integrated.
6. I thought there was too much inconsistency in this website.
7. I would imagine that most people would learn to use this website very quickly.
8. I found the website very cumbersome to use.
9. I felt very confident using the website.
10. I needed to learn a lot of things before I could get going with this website.
11. I found the website used terms that were easy to understand.

Part 2: Personal Perception of Preparedness

Likert Scale 1-5. Strongly disagree, disagree, neither agree nor disagree, Agree, Strongly Agree

12. I found the content of the orientation to simulation website:
 - a. Prepares me to work with the facilitator
 - b. Prepares me to understand my role in simulation scenarios
 - b. Prepares me to assess the patient manikin
 - c. Prepares me to find and apply equipment used in simulation scenarios

Part 3: Satisfaction

Likert Scale 1-5 from Extremely Dissatisfied, Dissatisfied, Neutral, Satisfied, Extremely Satisfied

13. How satisfied were you with the following aspects of the orientation to medical simulation website?
 - a. Ease of navigation
 - b. Overall design
 - c. Video presentations
 - d. Organization
 - e. Non-video content (e.g. text, information, instructions)

Likert Scale 1 – 5: Extremely unlikely, Unlikely, Neutral, Likely, Extremely likely

14. How likely are you to recommend this website to a medical student?

15. Briefly explain your recommendation of the website rating in the previous question.

Open text

16. Is there anything else you would like to share with the researcher?

Open text

Appendix M
Nielsen's Severity Rating for Usability Problems

Rating Description

0 Not a usability problem

1 Cosmetic problem only: fix only if time is available

2 Minor usability problem: fix should be given low priority

3 Major usability problem: important to fix, should be given high priority

4 Usability catastrophe: imperative to fix before product can be released

List of Changes

Problem #1: _____

Changes:

List of Changes

Problem #2: _____

Changes:

List of Changes

Problem #3: _____

Changes:

List of Changes

Problem #4: _____

Changes:

Appendix N

Wireframe of Webpages

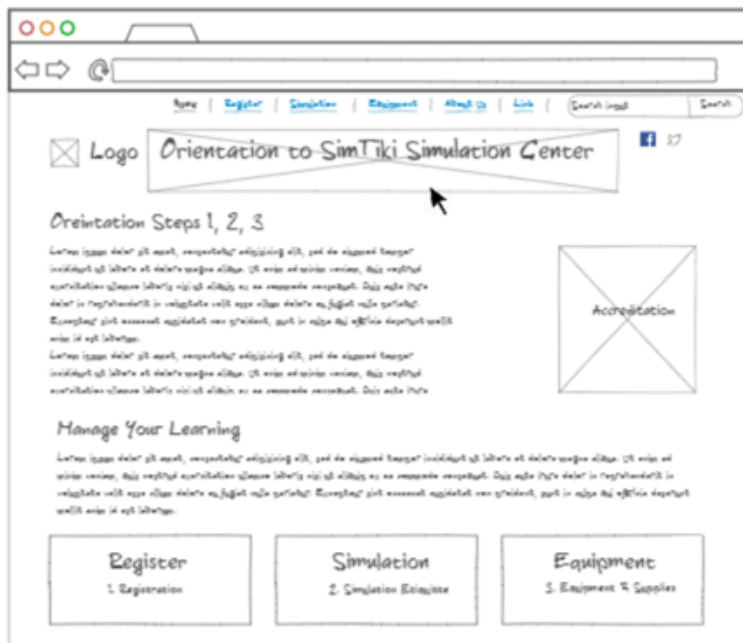


Figure B1. Home Page.



Figure B2. Create account and register.



Figure B3. Simulation and etiquette.



Figure B4. Simulation room, equipment and supplies.

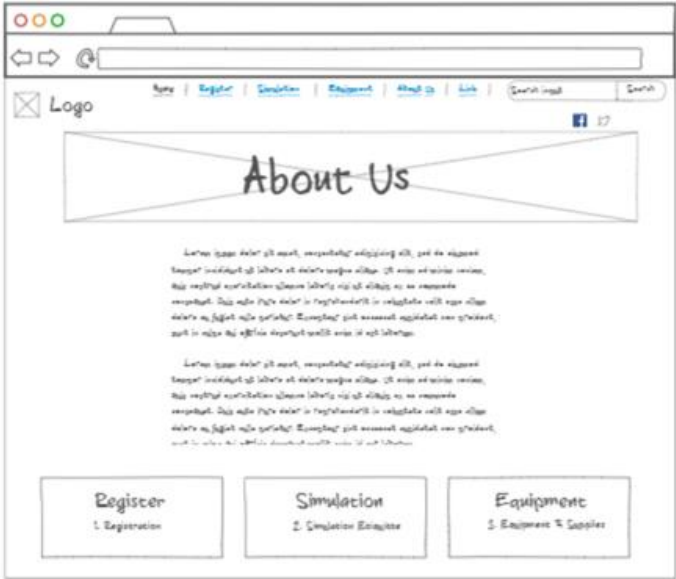


Figure B5. About us.


WordPress: <https://orientationtosimulation.wordpress.com/> (unpublished)

SimTiki Simulation Center Orientation to Medical Simulation

Medical simulation is a powerful way to practice and learn in a safe environment using high technology patient manikins, equipment, simulated patient scenarios and debriefing. This website will help you prepare for your simulation course. Aloha!


[Go to SimTiki.org](#)

Create Account




All users of the simulation center must create an account in our learning management system at [simitki.org](#). Learn how to register for a class and access precourse material.

Simulation



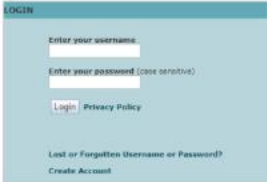
[Learn about the simulation and how to take advantage of this exciting learning environment.](#)
[Learn about the different roles of student and facilitator, patient scenarios and use of debriefing.](#)

Simulation Room



Your patient manikin will be presented in an environment such as an emergency room or hospital ward. Learn to use the patient monitor, locate equipment and more.

Step 1: Create Account



Login Section

- Step 1: Create an Account
- Navigate to [Simitki.org](#)
 - Click **Login** on the top right

To attend courses at SimTiki, you must **Create** an account and **Register** for a course. In this section you will learn about the following:

- Create Account
- Find your Course & Register for a Class
- After your class, complete post course surveys

Figure B6: Home and create account webpage.

Simulation

Simulation in Practice

Welcome to an exciting learning method to apply your knowledge into practice! Simulation is a strategy recommended by the Institute of Medicine to recover from medical errors, which are recognized as the third leading cause of death in the United States. In simulation, learners can practice medicine and teamwork using a robotic manikin patient in a safe learning environment.

[Medical Error Article](#)

Makary, M., & Daniel, M. (2016). Medical error—the third leading cause of death in the US. *BMJ*, 353, i2139.

Simulation in Medical Education

Welcome to SimTiki Simulation Center! Scenarios are opportunities for students to practice medicine in a **safe environment**. It is a good opportunity to try out your skills at the bedside. Simulation is a safe space to make mistakes! Unlike standardized patients, manikins can be programmed to have different cardiac rhythms, airway events and presentations like cyanosis or pupil changes. We encourage you to have fun in the challenge, engaging in the medical environment, and suspending your disbelief to practice what you learned in your tutorial group.

Figure B7. Simulation module webpage.


Simulation Room – Equipment & Supplies

Simulation Room – Equipment & Supplies

Your patient manikin will be presented in an environment such as an emergency room, hospital ward or even an operating room. Learning to use the patient monitor, locate equipment and getting acquainted with the patient manikin can help you focus on the learning objectives.

[Shameless SimMan Video](#)

We still have our first working SimMan patient manikin from 2005!



Simulation Room

The simulation room contains a patient manikin, patient monitor, IV pole with IV solution, emergency cart, and oxygen flowmeter.

Safety Warning: The emergency cart contains sharps (needle decompression syringe, advanced cardiac life support (ACLS) syringes contained in boxes, scalpel) and a

Figure B8. Simulation room webpage.

Appendix O CITI Certificate



Figure D1: CITI Human subjects research certificate.



Figure D2: CITI Information privacy security certificate.

Appendix P
University of Hawai'i
Consent to Participate in a Research Project



University of Hawai'i
Consent to Participate in a Research Project
Kris Hara, Principal Investigator

Project title: Orientation to Medical Simulation Website for Medical Students a Usability Study

Aloha! My name is Kris Hara and I am a graduate student at the University of Hawai'i at Manoa in the College of Education: Learning Design and Technology. As part of the requirements to earn my graduate degree, I am doing a usability study on a website created to orient students to simulation.

What am I being asked to do?

If you decide to participate in this study, I will meet with you at a pre-arranged day and time convenient for you. You may also arrange to meet through an online screen sharing application called Zoom.

Taking part in this study is your choice.

Your participation in this project is completely voluntary. You may stop participating at any time. If you stop being in the study, there will be no penalty or loss to you. Your choice to participate or not participate will have no effect on your student role at JABSOM.

Why is this study being done?

The purpose of the study is to evaluate the ease of use, content and design of an orientation website to simulation for medical students of the John A. Burns School of Medicine.

What will happen if I decide to take part in this study?

Before the study I will send you a demographic survey through email and Google Forms. The usability study will consist of 5 tasks for you to complete. I will ask you to think out loud as you complete the tasks. At the end of the study, I will ask you to complete a post-study survey.

Only you and I will be present during the face to face interview. With your permission, I will record your voice and computer screen during the interview so that I can later transcribe the interview and analyze the responses. With your permission, I will also ask to video record your screen so that I can analyze your cursor movements during the interview. It is estimated that the interview will take a total of thirty to forty minutes to complete the protocol and post survey. You will be one of about 12 people I will interview for this study.

What are the risks and benefits of taking part in this study?

I believe there is little risk to you for participating in this research project. Should you feel stressed or feel uncomfortable at any time, you may elect to skip a task, take a break or withdraw from the study completely. As compensation there is a small gift card for participants completing the study.

There may be some benefit to reviewing the information in the website regarding the topic of simulation. Data collected from the study may improve the website and may help students new to simulation in the future.

Privacy and Confidentiality:

I will keep all study data secure in a locked filing cabinet in a locked office/encrypted on a password protected computer. Only my University of Hawai'i advisor and I will have access to the information. Other agencies that have legal permission have the right to review research records. The University of Hawai'i Human Studies Program has the right to review research records for this study.



University of Hawai'i
Consent to Participate in a Research Project
 Kris Hara, Principal Investigator

Project title: Orientation to Medical Simulation Website for Medical Students a Usability Study

After I complete my data analysis, I will erase or destroy the audio and video recordings. When I report the results of my research project, I will not use your name. I will not use any other personal identifying information that can identify you. I will report my findings in a way that protects your privacy and confidentiality to the extent allowed by law.

Compensation:

You will receive a \$5 gift certificate to Starbucks for your time and effort in participating in this research project.

Future Research Studies:

Even after removing identifiers, the data from this study will not be used or distributed for future research studies.

Questions:

If you have any questions about this study, please call or email me at harakm@hawaii.edu. You may also contact my advisor, Dr. Daniel Hoffman at hoffman2@hawaii.edu. You may contact the UH Human Studies Program at 808.956.5007 or uhirb@hawaii.edu, to discuss problems, concerns and questions; obtain information; or offer input with an informed individual who is unaffiliated with the specific research protocol. Please visit <http://go.hawaii.edu/jRd> for more information on your rights as a research participant.

If you agree to participate in this project, please sign and date this signature page and return it to: harakm@hawaii.edu.

Keep a copy of the informed consent for your records and reference.

Signature(s) for Consent:

I give permission to join the research project entitled, "*Orientation to Medical Simulation Website for Medical Students a Usability Study*."

Please initial next to either "Yes" or "No" to the following:

☐ Yes ☐ No I consent to be audio-recorded for the interview portion of this research.

☐ Yes ☐ No I consent to being video-recorded for the interview portion of this research.

Name of Participant (Print): _____

Participant's Signature: _____

Signature of the Person Obtaining Consent: _____

Date: _____

Mahalo!

Appendix Q
Enrollment Log

#	Date Screened	Subject Initials	Screening Results			Date of Consent	Enrollment Number
			Pass	Fail	Reason for Fail		
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							

Appendix R

Usability Tasks - Facilitator Copy

You are a first-year medical student and you want to orient yourself to the SimTiki Simulation Center. You would also like to learn about how and why simulation is used in your medical education. As you understand the benefits of a manikin patient simulation, you would like to get acquainted with the simulation room and available equipment. We'll ask you not to use the search button to find information during these tasks.

Task	Description
Scenarios for Usability Study aligned with Research Question #1 (Make sure to use words that don't bias the participant) How <u>easy</u> is it for first year medical students to <u>navigate</u> the web-based orientation to simulation?	
Task 1	Please take a few minutes and explore the homepage of the website and verbalize whatever comes to mind. You may scroll but please don't click any links. (3 minutes)
Task 2	You are a new medical student and need to create an account in the SimTiki website. Locate the directions on how to do this.
Task 3	You wonder if it is okay to ask questions during a simulation. Locate the where you can find this information.
Task 4	Before your simulation scenario you wonder how you will get the patient's history. Locate where you would find this information.
Task 5	Find information on how to activate a new blood pressure reading during a scenario.
Task 6	You anticipate having to start an IV on the manikin during a scenario next week. Locate where you would how to do this.

Notes for Test Coordinator

Let the user attempt to perform that task themselves. If they ask you for help, is surprised by something that happens or makes a comment I may reply by saying:

1. "What are you thinking/looking at/doing now"?
2. "What do you think?"
3. "Is that what you expected to happen?"
4. "I'd like you to do whatever you'd normally do."
5. "What do you think you might try next?"
6. "What do you think that means?"
7. "What are you trying to do now?"

It is ok to paraphrase that the participant says to help clarify any statement or section on the website they have just commented on. Remember to maintain a neutral attitude and don't coach the participant.

Appendix S Timeline

Usability project timeline and tasks.

Date	Task
2019	
October	<ul style="list-style-type: none"> • Begin writing project proposal. • Begin the Institutional Review Board (IRB) approval process. • Create data collection tools such as surveys, record sheets, notes and templates.
November	<ul style="list-style-type: none"> • Continue drafting and revising project proposal. • Begin website design prototype <ul style="list-style-type: none"> ◦ Wireframes ◦ Content
December	<ul style="list-style-type: none"> • Finalize project plans for IRB approval • Continue refining website design prototype
2020	
January	<ul style="list-style-type: none"> • With IRB approval begin project implementation. • Send invitations to usability study participants. • Schedule interviews round number 1 • Usability study round number 1 and revision process
February	<ul style="list-style-type: none"> • Continue project implementation • Schedule interviews round number 2 • Usability study round number 2 and revision process • Schedule interviews round 3
March	<ul style="list-style-type: none"> • Usability study round number 3 and final revision process • Analyze data • Complete final paper draft
April	<ul style="list-style-type: none"> • Create Teaching, Colleges & Community (TCC) Presentation Slides • Conduct TCC presentation
May	<ul style="list-style-type: none"> • Complete final paper